The CRUSHED STONE JOURNAL

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Reports of Standing Committees Presented at Montreal Convention

(*Continued from March Issue*)

Sub-Committee for the Standardization of Drilling Equipment

This Committee held two meetings at the William Penn Hotel, Pittsburgh, Pa., one on August 14, and the other on October 2, 1925. The result of these meetings was the decision to recommend to the National Crushed Stone Association for adoption certain specific standards and sizes of well drilling tools that would tend to make it easier for the individual operator to obtain the equipment which he needed and to permit him to receive competitive bids for the furnishing of this material.

It might be of interest to present a brief history of the development of drilling equipment as a preface to the recommendations of this Committee. The first tool joints manufactured were straight somewhat on the order of a pipe thread. Shortly after this beginning, someone whose name has become lost, conceived the idea of tapering the joint in the belief that this would hold the tools together with less difficulty. This was so successful that the tapered joint was adopted by all manufacturers of well drill tools. There was, however, at this time so little harmony and cooperation between the manufacturers that the result was, that each manufacturer adopted his own taper, following, however, the pipe thread on large pipe, which was eight threads to the inch. This joint of eight threads sharp to the inch was used for a number of years, but a later development was that of making the joint seven threads to the inch, and making it flat top and bottom to avoid the breakage, which was occurring so frequently with the sharp thread joint.

So far as we know, a little shop in the oil country operated by Ireland and Hughes was among the first to adopt the seven-thread flat joint; and for reasons which they perhaps could not explain, they made the taper 24-lathe degrees to the foot, a lathe degree being 1/8 of an inch. Consequently the taper adopted was 3" to the foot and with all of the joints of different sizes, this same taper and number of threads was used. The various manufacturers of drilling equipment did not, however, use these same sizes. Consequently, the lathe degree differed widely, until eventually there were in the neighborhood of 265 different joints being turned or furnished in the United States. About twenty-five years ago a meeting of the manufacturers of cable or drilling tools was called in Pittsburgh and an effort was made at that time to adopt a standard. However, at that time little or nothing was accomplished. A few years later, the American Petroleum Institute, which is an organization known to all of us, conceived the idea of standardizing the cable drilling tool joints, as well as other drilling tools. The Committee which they appointed, after an investigation, decided that the Ireland and Hughes joint 7 threads, flat, to the inch, 60 pitch thread on a 24 degree taper was the best of all which they considered. Their recommendation was adopted by the American Petroleum Institute, and now all manufacturers of drilling equipment have arranged to furnish this joint, which was formerly known as the I. & H. but now as the A. P. I. standard joint. This taper tool joint is held together by the friction of the two faces, the thread on both the box and pin being merely a means of bringing the two faces together. In the use of these joints they should be kept free of oil or grease.

Your Committee has obtained the permission of the American Petroleum Institute to use their standards and respectfully recommends that the members of this Association should request that the joints of all tools furnished for well drilling purposes be marked "A. P. I." to indicate that these standards have been followed, and that the template used in making them has been checked with the standards of the American Petroleum Institute.

We further recommend that distinguishing marks for all steel bits and welded bits be adopted, the all-steel bit to have the total finished weight marked thereon and the welded bit to have marked thereon the weight of the bit steel, these weights to be stamped just above the end of the water course in accordance with the following ex-

(*Continued Page 8*)

The CRUSHED STONE JOURNAL
J. R. BOYD, Editor
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FREEZING AND THAWING TEST SPECIMENS TO BE BROKEN IN MAY

The first series of transverse tests on the concrete specimens which are being subjected to alternate freezing and thawing at the Arlington Experiment Station of the U. S. Bureau of Public Roads, will in all probability be made some time during the month of May, at which time the specimens will have been subjected to fifty alternations.

The test specimens, which are six inches in section and thirty inches in length, were fabricated from aggregates of different types and of varying quality. Three different mixes were used, the proportions being 1:1½:3, 1:2:4, and 1:3:6. Each type and quality of aggregate used was incorporated in each mix.

These specimens will be broken in two places by means of a special cantilever testing device for the purpose of obtaining the modulus of rupture. The broken fragments will then be tested for compression so that two values for modulus of rupture and two for compression for each test specimen will be obtained.

The object of these tests is twofold: First, to determine the effect of type and quality of aggregate on the resistance of the concrete to alternate freezing and thawing, and second, to correlate the effects of the freezing of the concrete with the soundness tests on the aggregates.

A Correction

We wish to call attention to an error which appeared in the March 1 issue of The Crushed Stone Journal. In the fourth paragraph, left hand column, page four, the figure 75c per ton should be 7.5c per ton.

Mr. Sanborn Gives Impressions Obtained at Kansas City Freight Rate Hearings

The following remarks by Mr. W. R. Sanborn were made at the Montreal Convention.

Whenever you go anywhere you get a very decided and definite impression of one kind or another. I went to Kansas City because I was asked by this Association to go. I got a very definite impression there, which is so vivid that I really do not know if I can stay on the track and give you any real information about Ex Parte 87, or whether you will find me off the track most of the time following up this rainbow.

The Interstate Commerce Commission heard the carriers at Chicago in the Fall. At that time they would not permit any cross questioning of the carriers and would not permit any evidence from the shippers. They were simply permitting the carriers to state their case without interruption. At a later hearing, also in Chicago, they permitted States organizations, such as State Railroad Commissions, and different other well organized interests, to present their case. At Kansas City the Commission arranged for the government organized industries to present their cases.

The only difference between David and Goliath and our Association at Kansas City was David was right where he had a nice stock pile of crushed stone, and could pick the size and kind of rock he wanted, and could throw it with some assurance he was going to hit somebody. In Kansas City I had the feeling that it was entirely clay soil around that country, and that there were no rocks or pebbles really worth while to take a shot at Goliath with.

The railroads went into the case beautifully organized. They knew just exactly what they wanted to do, and they knew just exactly how they wanted to do it. They knew exactly the things that would make the best impression upon the Interstate Commerce Commission, and they knew how to dish them out. I have not a word of complaint to make about the way we or our man handled the case, but I feel if the members of this Association could once realize the manner in which we tied our Counsel's hands when we sent him into that case, we would certainly reform and endeavor to do better next time.

One of the gentlemen who spoke last evening coincided with my views in a great many ways, and I am not claiming any particular merit for what I now tell you. Somebody said many years ago, before they ever thought of Rotary Clubs, or Kiwanis Clubs, that honesty was the best policy. I am here to tell you that this old idol which the stonemen have worshipped for a good many years—the sacredness of our production figures—is about due for an awful fall, and if the old idol does not get it, why, some of us will get it.

Mr. Burchmore sent out questionnaires, the answers to which would have been the finest kind of ammunition you ever had a chance to put up to an Interstate Com-

(*Continued Page 5*)

The President's Page

REORGANIZATION OF THE BUREAU OF MINES

In line with the plans of the reorganization of government departments with the object of eliminating duplication of effort and consolidating similar work in different bureaus under one head, the Bureau of Mines was last July transferred from the Department of Interior to the Department of Commerce. At the same time the Division of Mineral Statistics, of the United States Geological Survey, was also transferred to the Department of Commerce and combined with the Bureau of Mines. In order that the Bureau of Mines might be of the greatest benefit to the mining industry in general Secretary Hoover appointed an Advisory Committee composed of representatives of the different branches of the mineral industry to study the work of the Bureau and recommend a policy for its future work. Among other things this committee recommended the continuation of the technological work of the Bureau and in addition work of an economic character.

Acting on the recommendation of the Advisory Committee and Scott Turner, Director of the Bureau, Secretary Hoover has announced the establishment of an Economics Branch of the Bureau of Mines and has named C. P. White, formerly Chief of the Coal Division of the Bureau of Foreign and Domestic Commerce, to take charge of this work. This new branch will embrace the Division of Mineral Statistics, formerly part of the Geological Survey, and there has also been transferred to this new branch the major work of the Bureau of Foreign and Domestic Commerce on petroleum, coal and other minerals.

Mr. White, originally from Ohio, came into government service as Manager in charge of Lake and Canadian distribution of coal supplies under the U. S. Fuel Administration during the war and later as Assistant Federal Fuel Distributor in charge of fueling of the northwest following the strike in 1922. Mr. White's business career before entering government service covers years of experience in executive and administrative positions in the coal industry.

Following out the ideas of Secretary Hoover, the Advisory Committee and Director Scott Turner, the new Economics Branch will be concerned with the business of mining rather than the technical and engineering phases except in so far as they come into close relationship with the economic side. It is expected that this branch will be organized and under way July 1.

Within the Economic Branch of the Bureau there was established a Division of Metals and Minerals. A month or two ago Mr. Weigel of that Division called on us to inquire to what extent and in what ways the Division might be of service to the crushed stone industry, with particular relation to economic problems as distinguished from those of a purely technical nature. We were impressed not only with the breadth and scope of his experience, but also with his intelligent and sympathetic understanding of the non-metallic industries. We delayed making any specific suggestions to him as to investigations which might be conducted for the betterment of our industry until such time as we both might have an opportunity of consulting with Mr. Goldbeck as to what investigations by the Division might best accord with the proposed outline of work of our own engineering bureau which was published in a previous issue of the Journal. As a result of this joint consideration we have recently submitted to the Division through Mr. Weigel the following suggestions as to investigations which might be properly conducted for the good of the industry along economic lines of research:

1. Obtain statistical information as to the tonnage and sizes of crushed stone now wasted in various localities classified according to character of stone. The justification for such an investigation lies in the possibility of revealing so high a percentage of waste products as will warrant the making of intensive studies to find means for disposing of it. The investigation might well include suggestions as to the disposal of the waste material, which will largely, if not entirely, consist of stone screenings and dust.

2. Investigate in what ways, if any, the cost of producing crushed stone can be decreased by—

(a) Making a general survey of the various sizes produced in different districts with an analysis of the reasons for such sizing.

Such an investigation would aid in the work of standardization and simplification of sizes, a project in which the producers and users of crushed stone are alike interested.

(b) Obtain statistics on the relative proportions of different sizes produced in different districts.

Such an investigation would furnish information on the possibility of more efficient crushing and screening to more accurately meet the market demands in various sections.

3. Secure data relative to the cost to quarry operators of accidents to their employees and in connection therewith furnish information on ways and means of preventing accidents. Such an investigation has a direct economcial application bearing on the cost of producing crushed stone.

4. Investigate and secure statistics bearing on the effect of fires on the cost of production and in connection therewith recommend means for decreasing fire hazards. Such an investigation is justified by the possibility that as a result thereof the cost of producing crushed stone might to some extent be reduced.

(*Continued Page 4*)

The President's Page

(Continued from Page 3)

5. Conduct a study of the general items of cost involved in producing crushed stone and upon which cost information should be obtained throughout the industry. We do not refer to the standardization of a uniform cost accounting system but rather to stressing the particular items upon which costs should uniformly be kept. Such an investigation is of importance in an economic study of the crushed stone industry, particularly in enabling better cost comparisons to be made between various quarries and districts.

6. Obtain statistics on the length of haul on crushed stone from quarry to consumer. This should be done for each individual quarry. Such information would be of great importance in order that exact data may be available in connection with freight rate investigations and would be useful in contributing toward the establishment of a fair and just freight rate structure.

7. Investigate feasibility of winter storage of stone by quarries or by contractors or by state highway departments for the purpose of more nearly equalizing production throughout the year to relieve the peak demands thrown on quarries and possible inability to fully supply needs of contractors during peak demands, with resultant loss to contractors and delay in prosecution of work, thus affecting program of highway departments. Such investigation would be broad in its scope and of interest and value to crushed stone producers, contractors, state highway departments, and firms supplying equipment to road building projects.

It is the desire and duty of the Division of Metals and Minerals to be of assistance to industries falling within this classification, tho its investigations are properly limited to questions of general interest to the entire industry rather than considerations of local interest to individual quarries.

If any of our members care to suggest to us modifications of the foregoing outline or make any additions thereto, we will be glad to have them let us know so that we may communicate their thoughts to Mr. Weigel.

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Laboratories to Get Work Program

Mr. Goldbeck has recently suggested to us that the time is ripe for submitting to various laboratories of reputation and distinction the entire outline of work that it is proposed our Bureau of Engineering shall follow in order to ascertain what problems involved in this program may be investigated by these laboratories. It is believed that those agencies interested in highway construction and development will desire to assist us in our effort to contribute to some extent in the solution of problems of interest and value in highway design and construction. The Bureau of Engineering at present is not equipped to do any testing, even of an initial nature, and therefore we must rely on laboratories, largely government and state, interested in such investigations to assist in the program outlined in so far as they may with propriety and in the belief that such cooperation would be to the benefit of highway construction. We are proceeding accordingly. However responsive existing laboratories may be to our thought that we may mutually cooperate in the investigation of problems of interest to highway builders, we must not lose sight of the fact that we should establish in connection with the Bureau a laboratory sufficiently well equipped to enable Mr. Goldbeck to undertake initial tests in order that he may more thoroughly develop lines of research and investigation which it would be worth while to submit to government and state laboratories for further investigation. The present state of our finances does not permit of the establishment of such a laboratory as an adjunct to our Bureau; but this is the goal towards which we are definitely and earnestly working and which we must reach if the potentialities of the Bureau for service not only to our industry but to highway building in general and the users of our products in any form are to be developed to their fullest extent.

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Ohio Crushed Stone Association Holds Annual Meeting and Banquet

We had the good fortune to attend the annual meeting and banquet of the Ohio Crushed Stone Association which was held in Columbus on March 11th. State, county and town highway officials were present and joined with the crushed stone producers in considering matters of interest in highway construction.

Mr. Schlesinger, Director of Highways and Public Works for the State of Ohio, delivered a most interesting and instructive paper at the afternoon meeting on "Salvaging Old Macadam Roads." He indicated a mastery of his subject and a practical and common-sense point of view that made a direct and real appeal to his audience.

Mr. Goldbeck discussed in a scholarly and vitally interesting manner lines of investigation and research which will surely tend to increase the value and efficiency of bituminous road construction. His address was instructive and inspiring no less to the crushed stone producers present than to the road building officials.

(Continued Page 5)

The President's Page

(Continued from Page 4)

In the evening the banquet was attended by approximately 170 persons and rivaled in enthusiasm and spirit the one which so many of us recently enjoyed in Montreal.

The speakers on this occasion were Dr. Guyer, President of Findlay College; the Hon. John A. McDowell, of Ohio; and the President of the N. C. S. A. There were also short responses by Messrs. Schlesinger, Duncan, McIntire and Van Voorhis, the genial engineer of the Ohio Crushed Stone Association, who is known to a host of friends as "Van."

Our good friend, Mr. Evans, the President of the Ohio Association, presided in his usually capable and courteous manner at the afternoon meeting, and at the banquet that toastmaster who is without a peer, A. P. Sandles, was master of ceremonies.

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Association is Represented in I. C. C. Proceedings

On the day following the Ohio gathering we represented our Association before the I. C. C. in proceedings by certain sand and gravel interests in the South and in which we had intervened, presenting our contention that sand, gravel and slag should not enjoy lower freight rates than exist on crushed stone. We urged that there is no transportation reason why the rates on any one of these commodities should be lower or higher than on any of the others and cited the formal opinion of the Commission substantially to that effect. We firmly believe that in such decision as may be made by the Commission in the proceedings referred to, that no discrimination unfavorable to crushed stone in the matter of freight rates will eventuate.

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Mid-West Crushed Stone Producers Will Hold Meeting April 15

On April 15th in St. Louis the crushed stone producers of the Mid-west will assemble to discuss matters of interest to the industry. This will unquestionably be the largest gathering of producers ever held in that section of the country with the exception of our national conventions, nor will the attendance be confined exclusively to that territory. Mr. Goldbeck, Mr. Boyd and I are looking forward to being present and doubtless several others from the East will accompany us. Mr. Doolittle, our distinguished Canadian Vice-President and recent host at Montreal, writes that he will be on hand. We cannot but admire the spirit which prompts him to travel so great a distance in order to contribute his part, large tho we know it to be, in the advancement of the interests of our industry.

The meeting is under the general direction and supervision of Mr. Sanborn, Regional Vice-President for the Northern Division. Mr. Sanborn is taking his work as Regional Vice-President in a serious and earnest manner and has intelligently outlined to us his conception of the value that these offices may be to the Assocaition. We will have more to say as to this in another issue. This gathering of producers in his Division is but one expression of the service that the Regional Vice-Presidents may render the Association and the industry.

We believe that the meeting in St. Louis, open as it is to all crushed stone producers wherever they may reside and whether or not they are members of this Association, will result in increased membership from that territory. It seems to us that if we could clearly lay before each crushed stone producer the program of service to which this Association is committed, that every operator would become a member and lend his moral and financial support to the accomplishment of our purposes.

The inspiring enthusiasm and intelligent planning of Mr. Krause of the Executive Committee has assured the success of the St. Louis meeting and reflects the untiring effort forthcoming from him which was so important a factor in sending to Montreal the largest delegation of mid-western producers that ever attended one of our national conventions. Quarrymen from Tennessee and Kentucky, as well as those from states in the northern region, including Illinois, Wisconsin, Iowa, Minnesota, Missouri, Nebraska and South Dakota, will attend and we hope to have as our guests highway officials from several of these states.

Every crushed stone producer, regardless of his location, is invited to attend the St. Louis meeting at the Hotel Jefferson, April 15.

Mr. Sanborn Gives Impressions Obtained at Kansas City Freight Rate Hearings

(Continued from Page 2)

merce Commission. The statistics of the mineral resources of the country showed there were some 26 million tons of crushed stone produced in the western territory. Mr. Burchmore's questionnaires represented 13 million out of the 26 million. That is a proportion of which you may well be proud. Mr. Burchmore issued those questionnaires to all members in the district, and he received six answers within a reasonable time limit. I can well imagine how he felt about that time. Then he sent out a chaser, a different questionnaire, materially shorter than the first one; and he received a dozen or more answers to the first blank, and a few answers to the second.

Those questionnaires were all sent out on the old plan that the information contained in the answers was to be treated absolutely and entirely as confidential, and that no individual figures were to be divulged. The questions were, of course, fairly pertinent: "What was your output last year?" "What was your output for the year before last?" "What was your price before the war?" "What is your price now?" "What is your shipping radius?" "What is your rate?"

There was a lot of material which was very personal and very individual, but the information tabulated and set out in cold black and white would have been the finest ammunition anybody could have wanted in this particular case. Still, on account, of our old habit of concealing our figures, Mr. Burchmore was compelled to use the information in a general way.

(Continued Page 11)

Studies In Macadam Road Design

By A. T. Goldbeck, *Director*,

Bureau of Engineering,

National Crushed Stone Association.

Unquestionably the topic of macadam road design is a timely one and a full discussion should serve to crystalize our thoughts as to the ways in which we might improve this type. I think we will all admit the very strong potential possibility of improving every type of road that is built today. The minute we reach a satisfied state of mind on any subject, our development of that subject ceases. For years it has been my habit of thought to go clear back to the basic principles underlying the mechanics of any design, whenever I have attempted to study that design with an eye to its improvement. And so in considering the macadam type, I think it essential that we rely not on cut and try methods of improvement, but rather should we take steps which have been developed as a result of engineering analysis. I trust that none of us will be unwilling to admit of the possibility of making the macadam type an even better road than it is at present, just as it is possible to improve every other kind of road. Under the term "macadam type" I include broken stone base with a water-bound macadam top, with or without a bituminous surface treatment, a bituminous macadam or a bituminous concrete top. The present remarks, in short, deal with the "flexible" as contrasted with the "rigid" types of surfacing.

We have seen a great improvement in the design of concrete roads during the past several years, effected entirely as the result of carefully planned researches. Not only is the present day concrete road stronger than the old, thin-edged design of five years ago, but it also is freer of defects and requires less concrete.

Such accomplishments with concrete make one wonder if research might not produce similar benefits in other road types. Many thousands of miles of the so-called "flexible" types of roads have been built without any thought of trying to improve their design to make them better suited for present day needs. Our primary road systems are rapidly being built and it probably is true that those which remain to be built lie, for the most part, in the less densely traveled sections. In addition, there are many thousands of miles of roads of secondary importance remaining to be surfaced. Many of these roads both on the primary and secondary systems will not demand the highest types of surfaces and, in fact, in a great many instances, economy will require the use of very low types of surfacing, such as topsoil and sand-clay. Undoubtedly all types have their particular usefulness in serving the traffic needs and their selection is often very difficult for many bewildering factors must be considered.

In many localities the ruling or critical conditions will require the building of broken stone roads, invariably with some form of bituminous surfacing. In view of the almost utter lack of research effort on the macadam road type and because of the very apparent probability that this type will serve a very great usefulness in the many miles of road yet to be constructed, surely an intensive study of its design and construction seems well worth while.

The Macadam Road Design Problem

The macadam road should be considered as a structure which must resist external forces. To design any structure, the engineer must make an analysis of the forces and destroying agencies which act; then his task is to so proportion his structure that it will successfully and economically resist those forces and agencies. The rational design of a macadam road has not as yet been accomplished, probably because of the great complexity of the problem. But this should not deter us from attempting an analysis and perhaps through discussion, trial and further analysis there will be brought about better and cheaper flexible road types.

Let us first consider the forces to which a macadam road is actually subjected, and see how these forces are resisted. We shall omit any thought of surface disintegration for the present but shall confine ourselves entirely to the effects of heavy wheel loads.

The Forces Due to a Wheel Load

A macadam road in its most usual form, consists of a layer of crushed rock keyed with smaller stone and compacted by rolling. Ordinarily large stone, say from 2½ to 3½ inches in size is used in the base course, and smaller stone from 1½ to 2½ inches in size in the top. In addition to the compaction from rolling during construction, traffic further compacts such a layer, provided it is protected from surface raveling through the use of a binder. If it were possible to remove a slab from a macadam road and mount this slab as a simple beam on two end supports, it would be found that this beam would be capable of supporting very little external load. For practical purposes, then, the resistance to bending or "beam action" of a macadam surfacing is very slight.

Without even considering the possibility of a mathematical analysis let us review the forces which act in supporting a wheel load applied somewhere near the center of a macadam road. Several years ago by means of special soil presure measuring apparatus, the distribution of pressures under a broken stone slab was measured by the U. S. Bureau of Public Roads.* A curve of

*See Transactions of the American Society of Civil Engineers, Vol. 88, 1925, page 270, "Researches in the Structural Design of Highways," by A. T. Goldbeck, Bureau of Public Roads.

the general nature of that shown in Figure 1 was obtained. This curve shows how a macadam road distributes wheel load pressures to the subgrade. Notice that the vertical pressure on the subgrade is greatest under the wheel and tapers down to zero at a small distance away from the wheel. Notice that our ordinary as-

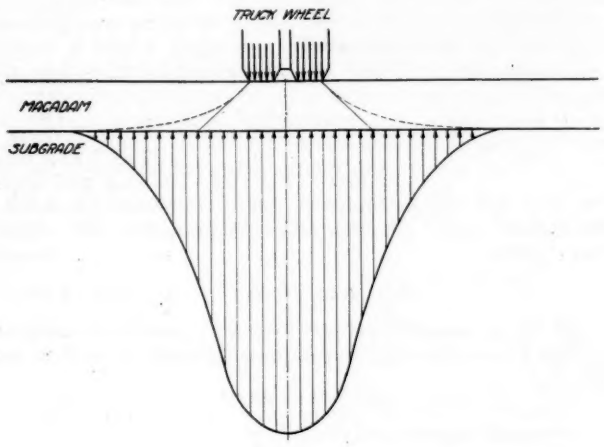

Figure 1.
Curve Showing Subgrade Pressures Under a Macadam Road.

sumption, that the entire load is supported on the subgrade included within lines drawn at 45 degrees from the load, is not quite correct, although most of the load is supported by that portion of the subgrade confined within these lines. The curves drawn would vary in both width and pressure intensity depending on the characteristics of the subgrade, and, also, without question, the degree of compaction, or keying of the macadam will likewise influence this distribution.

Influence of Compaction

If the stone were losely laid on the subgrade, the load would be spread, very largely by virtue of the overlapping of the individual stones upon those below. This is crudely illustrated in Figure 2, in which the short vertical lines at the contact points indicate vertical forces, only, acting on the stones. Here the load is spread over a comparatively small area of the subgrade. On the other hand suppose the layer of stone is well compacted and keyed. In this case as shown in Figure 3, a considerable amount of horizontal pressure is developed on each stone and, hence, considerable vertical friction exists at each point of vertical contact of one stone against its neighbor. Consequently when a load is applied on a given stone it is transmitted to the stones below not only by virtue of the fact that it rests on them directly, but also because the stones immediately adjacent to it carry part of the load which is transmitted to them because of the high frictional resistance between the adjacent stones. Also the cause of the high lateral restraint of the stones it seems entirely probable that considerable arch action might be de-

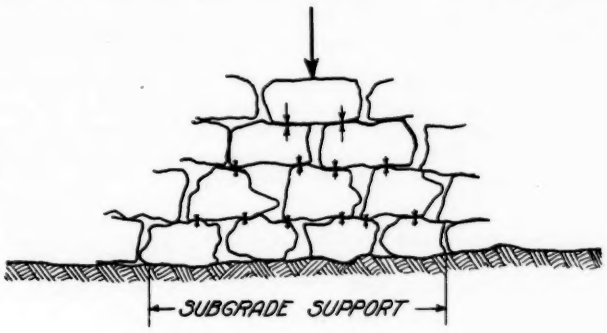

Figure 2.
Showing How Vertical Load is Carried to Subgrade Through Uncompacted Stone.

veloped under wheel loads. It follows, therefore, that the more compact the layer of stone, the wider will be the distribution of the wheel load over the subgrade. The follow-

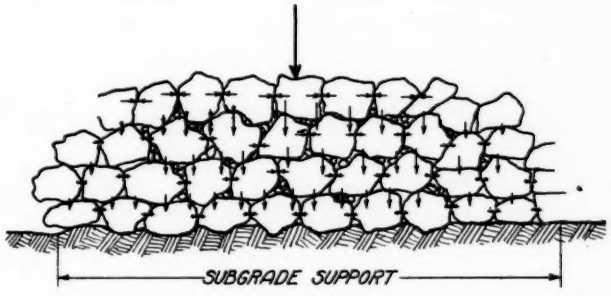

Figure 3.
Showing How Compaction Develops Horizontal Force and Hence Friction Which Aids in Transmitting Vertical Pressures Over Larger Areas Than When Stone is Uncompacted.

ing statement can be set down as one of great importance in the proper construction of a macadam base or roadway:

1. *Thorough rolling and keying should be used so that the individual stones shall be compacted tightly into position. High lateral restraint is thereby developed and wheel loads are better distributed over the subgrade.*

Effect of a Load at the Edge of the Macadam Surfacing

We have considered thus far a load placed at an intermediate position in the pavement. This is a very favorable position for distributing load to the subgrade, for here the surfacing material is wedged tightly into position by the

(Continued Page 10)

Sub-Committee for the Standardization of Drilling Equipment

(*Continued from Page 1*)

ample: A.S.-200, to indicate that the bit was all steel and weighed 200 lbs., W-175, to indicate that the bit was a welded one and that the bit steel weighed 175 lbs.

Your Committee recommends the desirability of standardizing on the following four sizes of holes for use in quarry work: 4½, 5, 6 and 8 in. and that the drilling tools be of such size and weight as will enable these holes to be drilled most economically.

The A. P. I. standards for the various sizes of blast holes recommended by your Committee are listed below:

Blast Hole Tools

Diameter of blast holes, in.

4½
5
6
8

Sizes of joints:

4½ in. Hole

1⅝ by 2⅝ in.—7 Tapered Joint with thread to conform to Flat U. S. Standard; 24 degree lathe taper, or 3 in. to the foot.

Length of Pin, in.	3½
Wrench Square, in.	2¾
Diameter of Pin Collar, in.	3⅝
Diameter of Box Collar, in.	3¾
Tapered Blank	

Length of Collars for Joints, in.

	For Stems	For Drilling and Fishing Jars	For Drilling Bits	For Fishing Tools and and Rope Sockets
Pin Collars	4	4	7	4
Box Collars	7	6	—	6

5 in. Hole

2 by 3 in.—7 Tapered Joint with thread to conform to Flat U. S. Standard; 24 degree lathe taper, or 3 in. to the foot.

Length of Pin, in.	4
Wrench Square, in.	3¼
Diameter of Pin Collar, in.	4¼
Diameter of Box Collar, in.	4⅜
Tapered Blank	

Length of Collars for Joints, in.

	For Stems	For Drilling and Fishing Jars	For Drilling Bits	For Fishing Tools and and Rope Sockets
Pin Collars	5	4½	8	4½
Box Collars	9	7	—	7

6 in. Hole

2¼ by 3¼ in.—7 Tapered Joint with thread to conform to Flat U. S. Standard; 24 degree lathe taper or 3 in. to the foot.

Length of Pin, in.	4
Wrench Square, in.	3½
Diameter of Pin Collar, in.	4½
Diameter of Box Collar, in.	4¾
Tapered Blank	

Length of Collars for Joints, in.

	For Stems	For Drilling and Fishing Jars	For Drilling Bits	For Fishing Tools and and Rope Sockets
Pin Collar	5½	4½	8	4½
Box Collars	9½	7	—	7

8 in. Hole

2¾ by 3¾ in.—7 Tapered Joint with thread to conform to Flat U. S. Standard; 24 degree lathe taper or 3 in. to the foot.

Length of Pin, in.	4½
Wrench Square, in.	4
Diameter of Pin Collar, in	5¼
Diameter of Box Collar, in.	5½
Tapered Blank	

Length of Collars for Joints, in.

	For Stems	For Drilling and Fishing Jars	For Drilling Bits	For Fishing Tools and and Rope Sockets
Pin Collars	6	5	8½	5
Box Collars	11	8	—	8

Specifications

Tolerances

A.—Maximum allowable tolerance on length of pins shall be Plus ⅛ in., Minus 0.

B.—Maximum allowable tolerance on Wrench Squares shall be Plus 1/16 in., Minus 1/16 in.

C.—Maximum allowable tolerance on diameters of Pin Collars and diameters of Box Collars shall be Plus 1/64 in., Minus 1/64 in.

D.—Maximum allowable tolerance on length of Pin Collars and length of Box Collars shall be Plus ½ in., Minus ½ in.

E.—Maximum allowable tolerance on depth to bore box for the pin shall be Plus ¾ in.

Basic Thread Form

A.—Profile. The angle between the sides of the thread is 60 degrees measured in the axial plane, and the thread is perpendicular to the axis of the joint. The crest is truncated on the taper an amount equal to 0.155, while the root is truncated the same amount parallel to the axis.

B.—Pitch. The number of threads per inch is seven, conforming to the U. S. Standard, measured in a direction parallel to the axis on the thread.

C.—Taper of Thread. The taper of the thread is 3 inches per foot, or 1 in 4, measured on the diameter.

Recommended Practice for Turning Threads

Threads made to the full basic form will develop an interference between crests and roots when assembled, due to the taper truncation of the crests and the straight truncation of the roots. It is therefore recommended that the threading tools be truncated an amount equal to .013 to avoid this interference. A simple tool form template known as center gauge should be provided to insure the proper shape of threading tools.

The taper threads in the box and on the pin shall be sized with standard templates using finger gauge or feeler.

MARKING OF JOINTS

Each joint manufactured in accordance with these specifications shall be stamped on the collar as follows:

Larger dimension of taper:—threads per inch : A. P. I.

For example, the 2¼ by 3¼ in. Joint would be marked
3¼—7 A. P. I.

The manufacturer's name shall be stamped on the Wrench Square.

TEMPLATES

The templates shall consist of a Plug or Pin, a Ring or Shell, and a Finger Gauge or Feeler.

The test for general size shall be made by screwing the taper plug into the taper ring. In a similar manner the taper ring shall be screwed firmly on the plug and a measurement made of the projection of the large end of the plug from the ring. In both cases the projection of the plug from the ring should measure 0.640 in.

TOLERANCE ON TEMPLATES

A.—Projection of any plug gauge from its mating ring shall be minimum 0.639; maximum 0.641 in.

B.—Projection of any plug or ring gauge interchanged with any other ring or plug gauge shall be minimum 0.637; maximum 0.643 in.

We recommend for adoption the following sizes of joints for the sizes of holes indicated:

Diameter of Hole, in.	Size of Joint, in.
4½	1⅝ by 2⅝
5	2 by 3
5⅝ or 6	2¼ by 3¼
8	2¾ by 3¾

The above sizes are for general conditions and are, of course, subject to alterations in individual cases to suit particular requirements.

We believe it inadvisable to make any definite recommendations in connection with the size of bit forgings, inasmuch as there is such a wide variation of dimensions now in use but believe that the bit should be approximately 4 ft. 6 in. in length.

In recommending diameters of drill stems, we believe it well to allow a certain latitude in order to meet varied conditions. The diameters recommended are as follows:

Diameter of Hole, in.	Diameter of Stem, in.
4½	3 to 3½
5	3½ to 4
6	4¼
8	4¼ to 5

The length of stem will be in accordance with the recommendation of the well drill manufacturer for use on the particular drill.

The drilling jars for the various sizes of holes are to be—

Diameter of Hole, in.	Diameter of Jars, in.
4½	3¾
5	4⅜ to 4½
6	4¾ to 5
8	5 to 5½

A stroke of 6 in. is recommended for all drilling jars.

The fishing jars are to be the same diameter as the drilling jars. The stroke for these, however, will vary from 12 in. to 24 in. in accordance with the conditions under which the work is being done.

We believe that a great deal of difficulty may be avoided by using the correct size of rope for the weight of the tools in use. We therefore recommend the following:

Weight of Tools, lbs.	Diameter of Rope, in.
Up to 600	1½
600 to 800	1½ to 1¾
800 to 1000	1¾ to 1⅞
1000 to 1500	1⅞ to 2
1500 to 2000	1⅞ to 2⅛

Your Committee gave some consideration to the question of wrenches and respectfully suggests that this subject be given further and careful consideration by the various manufacturers in an endeavor to lessen the weight of these without decreasing their serviceability.

We have at this time no recommendations to offer with regard to sand pumps, bailers and fishing tools.

It is our opinion that the relative merits of the use of Manila cable and wire rope in drilling could well be given further thought and study by a Committee of this Association.

Your Committee believes that only a start has been made in the recommendations for the standardization of drilling equipment and respectfully suggests that a similar committee should be appointed and instructed to proceed with this work.

Respectfully submitted,

FRANK S. JONES,
Secretary of the Sub-Committee
for the Standardization of
Drilling Equipment.

Studies In Macadam Road Design

(Continued from Page 7)

surrounding compacted mass of stone. At the sides of the road, however, the stone is held laterally only by the earth shoulders and in the spring of the year this restraint is almost zero. Undoubtedly then, one of the weak points of the macadam road is the lack of sufficient lateral restraint for the stone at the sides and here an improvement in design might well be attempted.

Effect of Road Thickness

Obviously if the wheel load be placed directly on the subgrade, the full load is supported over the area of contact of the wheel with the subgrade and the subgrade pressure under the wheel is then of the greatest intensity possible. If a layer of stone be used the pressures are spread over a wider area on the subgrade and consequently the intensity of pressure is decreased.

2. *The thicker the layer, the lower is the intensity of wheel load pressure on the subgrade.*

This, too, has been definitely proven by means of special tests made to determine the distribution of loads through earth fills. The laws governing the influence of the thickness of a stone layer on pressure distribution to subgrades of different supporting characteristics are unknown and this is a fundamental research which should be undertaken.

Influence of the Subgrade

Obviously the softness of the subgrade will influence the wheel load distribution and wider pressure distribution can be expected over a soft subgrade than over a hard non-yielding material. The subgrade plays a vital part in affecting the stability of a broken stone surfacing. If the pressure transmitted be too great, the subgrade will yield under the load and immediately high shearing stress will result in the road surfacing which will destroy its mechanical bond and render it much more susceptible to destruction from subsequent loads. Moreover, considerable yielding of the subgrade under a wheel load will result in plastic flow of the subgrade material and this causes a pushing up of the surfacing on each side of the load. If the load is placed near the side of the road, plastic flow will take place with greater ease toward the side of the road and under such adverse subgrade conditions, broken stone surfaces develop depressions near the side and the extreme edges might be raised and moved out toward the shoulders.

3. *A broken stone road requires excellent subgrade support.*

The important point is that the unit pressure transmitted by the surfacing to the subgrade be kept well within a value which will cause excessive subgrade movement. As already pointed out this means:

A. The use of sufficient thickness of stone.

B. Its proper compaction and to these should be added,

C. The adoption of means to increase the subgrade resistance to the highest possible value.

Subgrade Characteristics

Unquestionably the subgrade plays a major role in influencing the stability of a broken stone road subjected to heavy traffic, and it becomes important that the subgrade characteristics be taken into consideration. Soils vary widely in their physical properties, due to the extremely wide differences in their physical and chemical make-up and to the manner in which they have been formed. Soils have resulted from the decomposition of a wide variety of rocks, and these decomposed products have been deposited under widely different circumstances. Naturally then, soils vary from those which are extremely finely divided or colloidal in their nature to the coarse grained sandy or gravelly materials. Much has been written on the methods used for analysing and classifying soils from the road building standpoint. In general, it might be said that the extreme characteristics of subgrade soils are as follows:

Bad Soils	Good Soils
a. Extremely fine state of subdivision (as in clays).	a. Coarse, granular texture
b. High moisture capacity	b. Low moisture capacity
c. Extreme plasticity	c. Non-plastic when wet
d. Difficulty of drainage	d. Easily drained
e. Low bearing value	e. High bearing value
f. High volume change	f. Low volume change

It is highly important that the above subgrade characteristics be fully considered and—

4. *The design of a broken stone road must be suited to the particular subgrade upon which it is supported.*

Influence of Moisture in the Subgrade

If the percentage of moisture could be kept sufficiently low probably all soils would furnish adequate subgrade support. The difficulty, however, is that some soils such as the clays have an extremely high capacity for water and they are very adversely affected by moisture principally because they are thereby rendered extremely plastic and of low support. It is extremely difficult to drain this type of soil but one of the most hopeful possibilities of betterment in broken stone road design lies in the direction of more effectively ridding the subgrade of excess water. We might set it down as an important principle that—

5. *It is highly important that suitable measures be taken to drain away excess moisture from the subgrade.*

Possibility of Improving Bad Subgrades

It goes without saying, that if granular soils furnish good support, and plastic soils poor support, it will be quite possible to improve a bad soil by the admixture of enough good material. The use of an admixture of sand with a clay soil to form a sand-clay road surfacing is a typical example of this procedure and such a surfacing forms an excellent foundation for a broken stone road. The much discussed "stage" construction of the South consists of the building of a sand-clay or top-soil road for the small amount of traffic then to be accommodated, to be followed later with a higher

type of surfacing, often a bituminous macadam. The use of a layer of granular material such as fine stone screenings, cinders, fine sand or similar material would also be beneficial for several reasons.

A. Because such a layer would serve as so much more effective thickness for distributing the load to the subgrade.

B. Because such a layer would greatly aid in preventing the upward intrusion of clay into the broken stone layer, thereby preventing its full effective depth from being decreased through lubrication of the stone by the clay.

C. Drainage of the upper layers of the subgrade would be facilitated and the accumulation of capillary moisture in the upper layer would be lessened.

Admixtures of certain materials which might improve the physical characteristics of plastic soils are also not without possibility and are under experiment at the present time by several agencies. A few states have been using a granular sub-base under their pavement surfaces with very good results.

6. *A sub-base of granular material having characteristics listed above for good soils would be beneficial under macadam roads laid on bad subgrades.*

From the foregoing discussion it is clear there are certain well-defined lines along which macadam road design might be revived, entirely from the standpoint of improving load-carrying capacity. These changes should aim—

A. To improve the drainage of the subgrade.

B. To prevent clay intrusion into the broken stone surfacing.

C. To increase the load bearing capacity at the edges of the road—

(a) By providing greater lateral support at the edges.

(b) By decreasing the ratio of subgrade pressure to subgrade resistance.

Studies are now being made in macadam cross-section design with the above objects in view and a discussion of these cross-sections will appear in a subsequent issue.

Mr. Sanborn Gives Impressions Obtained at Kansas City Freight Rate Hearings

(*Continued from Page 5*)

Of course the well organized carriers were not at all slow in taking advantage of the position. They called attention to the fact that those figures upon which our Traffic Expert, Mr. Wilson, testified gave them no opportunity to cross-question the source of the figures. In other words, if I made the statement that my prices had increased so much, while our freight had increased more, the railroads were not in a position to cross-question the individual as to just how authentic his information was—and they made the most of it.

The carriers had testified that prices on stone—and, you know the way they put it—had increased out of proportion to the increase in freight rates, that the average cost of crushed stone today was $1.74 a yard, I think—and when that was chased down it was found to be the price at New York. Mr. Burchmore made very good ammunition by proving that prices in New York had nothing to do with prices in the western part of the country.

The object of the carriers was to show prices had increased out of proportion to the freight rates.

We introduced exhibits, and without bothering you with the details, or giving you too many figures, the net result was that prices of crushed stone in the United States increased 49% from 1917 to 1923 and 1924. The average freight rate increase in the State of Illinois during that time was something like 75%. We had exhibits which showed the increases from specific points to destinations on various railroads, which, in effect, covered the State of Illinois. Mr. Dolese, of Dolese Brothers Company, (who own a string of quarries extending from Rock Island into Oklahoma, and possibly Texas) testified as a producer having a wide interest in the territory involved. I testified as a producer from Illinois who would be acquainted with the Illinois situation.

Let me assure you, gentlemen, the work of the National Crushed Stone Association is not yet completed by a long way. There are more jobs in the future than we even have time and patience to catalogue at present, and they bob up every once in a while in a manner which makes us wish we had recognized the existence of those things a little quicker, and had done a little preparation work.

The railroads took an awful wallop at our Traffic Expert, Mr. Wilson, of St. Louis, because he did not know how many members the National Crushed Stone Association had in that particular territory, and did not know what proportion of the total tonnage of that country the National Crushed Stone Association represented. I do not want you to think they made a fool of him by any means, but we lost an opportunity of presenting a beautiful exhibit by which we would have shown that the National Crushed Stone Association represented practically all the big tonnage in that territory.

The Government statistics are tabulated and they show there are, roughly, some 1500 stone producers in the United States. Mr. Burchmore took the trouble to put this material into an exhibit which showed that practically one-third of the 1500 are in the territory affected by Ex Parte 87. I took the trouble to go through your report of the membership Committee, and I found about 50 of the members of the Association are in that territory. So, the ratio is something like 10%. This shows we have an unlimited field upon which to draw in the future as to our membership.

(*Continued Page 12*)

Mr. Sanborn Gives Impressions Obtained at Kansas City Freight Rate Hearings

(*Continued from Page 11*)

The carriers, with their beautiful organization, are in a position to make ammunition out of this, and we should be in a position where we have the information available for use at any time necessity may arise.

The Membership Committee could give us a lot of valuable information if we as producers would individually and severally be willing to put in black and white just exactly who we are, what we are, and where we are. It is a very simple matter to take the Government statistics and find out, state by state, how many quarry industries there are, and the total production of the various classes of crushed stone in each and every state. When this Association will take the pains to compile, state by state, the absolutely true facts as to the output of our members, we will have ammunition which will bear some weight—more weight, in fact,—on an Interstate Commerce Commission, than any other one thing I can well imagine. And, I do not see how it can injure any of us. I did not feel it would injure me in any way, and I put in an exhibit as an individual quarryman.

We handled the case along three lines: to show our situation as individuals, to show our situation as a State, and to show the situation as an entire group of States represented at the hearing. The exhibit I put in showed our production, and our actual average price per ton in 1917, 1923, and 1924. It also showed a comparison of our prices before and after the war, with the increase in our rates. The increase in our rates has been way out of proportion to the increase in the prices we are getting for our products. This was one of the things unanswered as far as the stone industry was concerned.

Another thing was our shipping radius. The carriers had a very nice exhibit in which they had included all the stone shipped in this country, taking in marble, which comes in at New York and is shipped, say, to San Francisco, if there is any such movement. They averaged it all up, taking in clay products, crushed stone, sand, and gravel, as well as the enameled brick business, or some particular texture of brick manufactured in New York and shipped to Chicago, or Omaha, or anywhere else. The railroad reports showed the shipping radius of stone, sand, brick, and clay was something over 400 miles. The brick people, who were just ahead of us, showed that common brick had a shipping radius so far below 400 miles that this figure was a huge joke, and Mr. Burchmore very wisely had prepared similar figures for the stone industry.

The rough and tumble of it was the shipping radius for crushed stone was 100 miles, and even less.

One of our members, in answer to a criticism I directed to him about his delay in answering the questionnaire said: "There is a lot of work involved in it." Mr. Burchmore made it quite plain what he wanted was figures which were more or less approximate, without going into detail. This gentleman to whom I refer said it would have been an awful job for him to figure out his shipping radius. I said: "Yes, but you know whether your shipping radius is 100 miles, or 200, or 50 or 75, don't you;" He said: "Well, I suppose it is about 75 miles." I had guessed mine was about 100 miles. Then they asked me to go to Kansas City, and I took the trouble to find out definitely what my shipping radius was on the Illinois Central Railroad in 1924, and I found it was 121 miles.

The big point was our attorney wanted general figures that would give him an idea of the shipping of the crushed stone industry, and the detailed information that any shipping radius was 100 miles or 121 miles, had no particular significance. Mr. Burchmore wanted a general idea of our shipping radius, because the carriers had put forward the contention that the shipping radius was something over 400 miles. Mr. Burchmore appreciated the situation, and asked for this information, and we should have been prompt in giving it to him.

I hope that we as individuals may all profit by the situation which has arisen, and be more liberal in our responses when the Association feels it is necessary to gather information for our own good and protection.

A DOZEN DON'TS ON SELLING

(*Contributed by One of Our Members*)

1. Don't ever tell a customer a lie. If you can't tell him the truth, then keep still. You will win his confidence in the end.

2. Don't knock your competitor. If your customer claims due praise to this competitor, say, "I grant you that, but—," and then plead your case.

3. Don't sulk if you don't get an order you have worked hard on. This man is going to do work again where in all probability you will sell him.

4. Don't let your attention to the customer cease on obtaining his orders. Keep following the jobs. Perhaps you can help him sometime.

5. Don't give up the hope of selling even a few carloads on every job you follow until the job is finished.

6. Don't solicit an order if you can't fill it.

7. Don't refuse to fill in no matter how small the quantity. A friend in need is a friend indeed.

8. Don't talk your customers over with anyone.

9. Don't ever think the customer is wrong, for he is always right! Then adjust matters the best way possible.

10. Don't fail to be ahead of time for an appointment.

11. Don't fail to give a customer service. He will pay more money for reliable service.

12. Don't let the order get away from you, but if it does, bear in mind some of the above.